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The Impact of Value Engineering in Construction: Enhancing Project Efficiency and Cost-Effectiveness Taking a Case Study of Mobolaji Bank Anthony Towers At Plot 5, Okotie Eboh Street S.W. Ikoyi, Lagos State

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***Abstract* - This journal explores the significant impact of value engineering in the construction industry, focusing on its ability to enhance project efficiency and cost-effectiveness. Value engineering (VE), a systematic and interdisciplinary approach, enables project stakeholders to optimize resources, improve quality, and maximize value throughout the construction process. By identifying and eliminating unnecessary expenses while maintaining performance requirements, value engineering empowers professionals to make informed decisions that lead to more sustainable and successful construction projects. it aims to provide insights into the fundamental principles, benefits, and challenges of value engineering, offering a comprehensive understanding of its impact on the construction industry By examining the principles, benefits, challenges, and case studies associated with value engineering in construction, emphasize the significance of value engineering in achieving project success. By embracing value engineering methodologies, construction professionals can optimize resources, minimize costs, and improve project outcomes, ultimately contributing to a more sustainable and efficient built environment.**

Keywords: value engineering, construction, cost effectiveness, project efficiency, quality.

I. BACKGROUND STUDY

Created by Broad Electric Corp. during WWII, esteem designing is currently widely utilized in business and government, remarkably in military, transportation, development, and medical services. Esteem designing is an expense cutting, efficiency supporting, and quality-improvement technique. It could be utilized in equipment and programming advancement, creation, and assembling, as well as details, principles, contract necessities, and other procurement program desk work, as well as office plan and development.

The meaning of value Engineering "an examination of the elements of a chief organization's program, project, framework, item, thing of gear, building, office, administration, or supply, performed by qualified office or worker for hire faculty, fully intent on further developing execution, dependability, quality, wellbeing, and life cycle costs." It can be effectively introduced at any point in a product, system, or method's life cycle. VE is a methodology for looking at a thing's or alternately cycle's capabilities to lay out "best worth," or the ideal connection among worth and cost. As such, the "best worth" thing or interaction is one that reliably satisfies the required central capability while having the most minimal life-cycle cost. Because "costs" are measurable, "cost reduction" is sometimes seen as the single requirement for a VE application, and thus is the focus of this text. However, the true goal of VE is "value enhancement," which may not result in an instant cost decrease.VE is a precise, minimal expense way to deal with surveying the "esteem" of an undertaking. On construction projects, VE can typically be used for the following advantages:

- Reductions in costs;
- Time reduction (schedule reduction);
- Enhancements in quality;
- The isolation of design flaws. (Value Standard and Body of Knowledge SAVE International, 2007)

II. AIM AND OBJECTIVES

The purpose of this study is to emphasize the significance of value engineering in achieving project success by embracing value engineering methodologies, construction professionals can optimize resources, minimize costs, and improve project outcomes, ultimately contributing to a more sustainable and efficient built environment.

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Objectives

1) Examine the benefits of applying value engineering to construction projects in Lagos state.
2) Know when to apply value engineering.

III. LITERATURE REVIEW

Value engineering (VE) is a type of administration that tracks down the most effective way to facilitate exercises between cost, quality and efficiency. Building a standing and a solid way to deal with tackling difficult issues can diminish expenses and transport or increment execution and quality.

A) Value engineering can have a number of positive effects on construction projects

Some of the main benefits are as follows:

Cost savings: Value engineering helps identify unnecessary costs and find alternative solutions that offer the same functionality at a lower cost. By eliminating wasteful practices, optimizing materials, and streamlining processes, value engineering can lead to significant cost savings in both the short and long term. (N. Galipogullari, 2007).

Enhanced functionality: Value engineering focuses on improving the performance and functionality of a product or system. By analyzing the needs and requirements of stakeholders, value engineering can identify opportunities to enhance features, increase efficiency, and improve overall performance.

Increased quality: Value engineering seeks to identify potential quality issues and find solutions to prevent or mitigate them. By examining the design, materials, and manufacturing processes, value engineering can help enhance the quality of the end product, reducing defects, and improving customer satisfaction.

Improved sustainability: Value engineering considers environmental factors and sustainability principles. It can identify opportunities to reduce waste, energy consumption, and environmental impact. By optimizing resource usage and promoting sustainable practices, value engineering contributes to a more eco-friendly approach.

Risk mitigation: Value engineering assesses potential dangers related with an item, framework, or task. By recognizing and tending to these dangers right off the bat in the plan or arranging stage, esteem designing can assist with limiting expected issues, further develop well-being, and lessen the probability of expensive deferrals or disappointments.

Collaboration and communication: Value engineering encourages collaboration among stakeholders, including designers, engineers, manufacturers, and end-users. By involving different perspectives and expertise, value engineering fosters effective communication and teamwork, leading to better solutions and a more cohesive project.

Long-term value: By optimizing costs, performance, and quality, value engineering helps maximize the long-term value of a product or project. It considers the life cycle costs and benefits, ensuring that investments are worthwhile and sustainable over time.

B) When to Use Value Engineering

Value engineering should be done as soon as possible—before funds are committed or systems, services, or designs are approved—to get the best results (A. Dell'Isola 1997). As shown in Fig. 1 the potential savings generated by VE applications are significantly greater at earlier project stages. Commitment of expected reserve funds from VE applications is a lot more prominent at prior phases of a task, as shown in Fig. 2. At the point when VE is applied later, two things increment: the venture expected to execute any progressions and protection from changes.

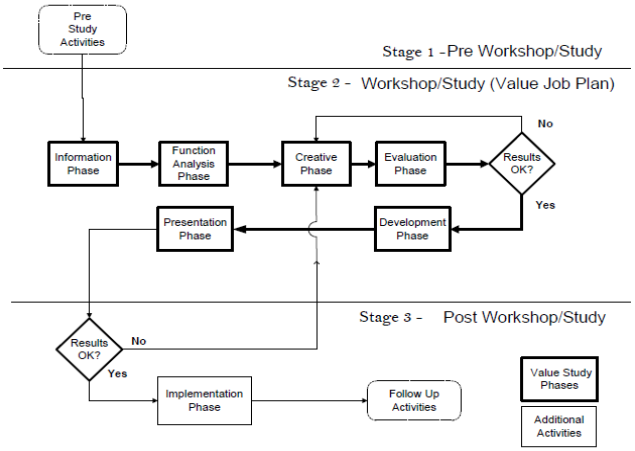

Figure 1: The job plan

Source (value standard and body of knowledge, 2007).

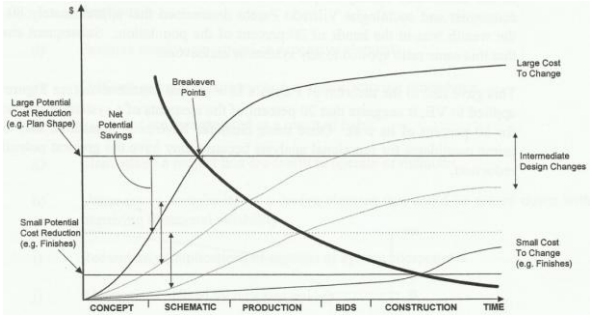

Figure 2: Potential savings from ve applications

Source (value engineering handbook, 2000).

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IV. METHODOLOGY

The methods use for assessing the impact of value engineering in construction is the primary source which entails carrying out a case-study in Lagos state and the secondary data collection is from journals and articles.

Case-study:

A case study of mobolaji bank anthony towers at plot 5, okotie eboh street S.W. Ikoyi, lagos state is done to assess the impact of value engineering done during construction.

Brief/functional requirements:

The proposed development of a 5 (five) storey super luxury apartment block, comprising 12 (twelve) flats, children play area, swimming pool with saunas, generator house and underground water tank.

- 4 bedroom en-suite
- Living Room
- Dining
- Executive Kitchen with store
- Pre Sit area
- Laundry
- Maid Bedroom
- 2 Nos Lift
- Main Staircase and Escape Staircase.

Floor:

Solid concrete floor was specified however changed to hollow clay pot during construction;

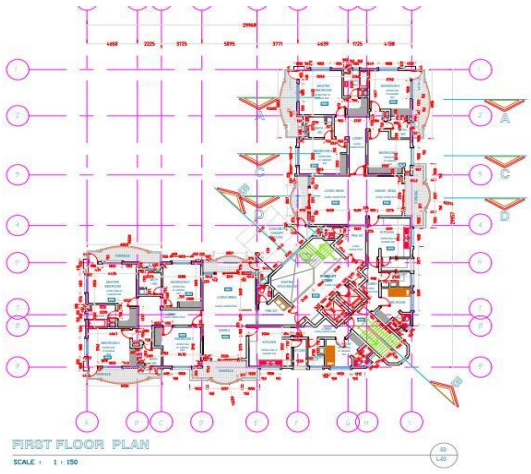

Figure 3: Floor plan

Source: Authors field work.

Hollow clay pot floors, also known as clay pot and concrete ribbed floors, offer several advantages over concrete floors. Here are some of the key advantages:

A) Lightweight construction: Hollow clay pot floors are lighter in weight compared to solid concrete floors. This makes them particularly suitable for upper floors in buildings where reducing overall structural weight is desired. The lighter weight can lead to cost savings in terms of materials, construction time, and foundation requirements.

B) Thermal insulation: The air-filled cavities in the clay pots provide natural insulation, which can help regulate the temperature within the building. This insulation can reduce the need for additional insulation materials and contribute to energy efficiency by minimizing heat transfer.

C) Sound insulation: The hollow spaces in the clay pots can also act as sound barriers, reducing the transmission of sound between floors. This can be beneficial in buildings where noise control is important, such as residential or commercial structures.

D) Improved fire resistance: Hollow clay pot floors have inherent fire-resistant properties due to the use of clay pots. Clay is a non-combustible material that can withstand high temperatures. This characteristic can enhance the fire safety of the building and provide additional time for evacuation and firefighting efforts.

E) Easy installation of services: The voids in the clay pot floor system allow for easy installation of electrical and mechanical services, such as wiring, plumbing, and HVAC systems. These services can be routed through the hollow spaces, reducing the need for additional chases or false ceilings.

F) Sustainability: Clay is a natural and environmentally friendly material that can be sourced locally, reducing the carbon footprint associated with transportation. Additionally, clay pot floors can be reused or recycled, promoting sustainability in construction.

Plate 1: Showing placing of electrical pipes along the clay pots

Source: authors field work.

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Plate 2: Showing placement of form work for columns
Source: authors field work.

Facade:

The external facade of the building, initially, it was to be plastered, part of it painted and the rest to be finished with facing bricks but we later suggested Tyrolean the entire facade with some colour design pattern. This saves a lot of cost as well

Roof:

The roof is still long span aluminium roof over treated hardwood timber members. No value engineering was done on the roof.

V. RESULTS AND DISCUSSIONS

The below calculation shows how value engineering has impacted on the case study carried out at ikoyi in terms of cost reduction, easy installation to save time and sustainable feature the materials used posses:

Area of First Floor = 578 SQM
Thickness of Slab = 150MM
Volume of Concrete = 578*0.15 86.7M^3
Cost of Concrete/M^3 = 60,000
= 86.7X60,000 = #5,202,000
Note; the cost of concrete is void of reinforcement
Cost/m^3 for reinforced concrete = 65,000
= 87.7m^3X65,000 = #5,635,500

Area of First Floor = 578 SQM
Thickness of Slab Required For Ribbed Slab = 0.05m
Volume of Concrete Required For Floor with Area 578 SQM =2.8G Approx. =30M^3
Cost of Reinforcement in Ribbed Slab = #65,000 *30 = #1,950,000
Difference in Price;
Conventional Floor Slab Casting = #5,635,500
Ribbed Floor Slab Casting = #1,950,000
Difference; #3,685,500
Note; 25% Volume of Concrete was Saved.

VI. CONCLUSION

Outcome of an undertaking, settling on where and how a venture will be constructed, finish of the construction as indicated by wanted plan and building quality, inside resolved time and cost limits, are conceivable with great assessments and arrangements. Authenticity of assessments is totally in direct extent to progress. Doing address assessments is firmly founded on the information level of the group. Esteem engineer accepts directing and examining obligations to expand the worth of the venture while forestalling pointless expenses.

It is preposterous to expect to apply VE on each task an organization produces. Significantly more effective worth designing investigations can be completed on complicated and large activities which have high capability of reestablishing the speculation. Naturally, value engineering projects cost money, so this one needs to be big enough to cover those costs and make a profit.

The reason for esteem designing isn't simply decreasing the expenses, expanding the plan norms, making it simpler to construct the venture and setting aside time and cash. VE should make a harmony between every one of the necessities of the task.

Creation techniques created with VE are done to decrease the expenses of an item without forfeiting the quality, keeping the expense fixed by expanding the quality or shortening the creation time. It will be always remembered that VE works are the reserve funds of worker for hire as well as investment funds that are made in the undertaking in heading of the worker for hire's and the client's advantages. A form of financial savings comes from the contractor's own savings.

VII. RECOMMENDATION

Based on the literature review and case study carried out, the researcher offers the following recommendation:

- Involve esteemed designing experts from the get-go in the undertaking project life cycle to augment cost-saving potential and distinguish valuable open doors for enhancing project assets.
- Participate in the value engineering process with subject matter experts and seasoned professionals to guarantee that the proposed changes are in line with industry standards and best practices, preserving or improving the project's quality and performance.
- Conduct comprehensive risk assessments throughout the value engineering process, considering factors such as safety, environmental impact, regulatory compliance, and long-term sustainability.

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- Foster an organizational culture that encourages innovation, creativity, and open mindedness, empowering team members to propose and implement novel ideas during the value engineering process.

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